(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 907 044 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.04.1999 Bulletin 1999/14

(51) Int. Cl.[6]: **F16H 61/30**

(21) Application number: **98118598.6**

(22) Date of filing: **01.10.1998**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **02.10.1997 IT TO970873**

(71) Applicant: **IVECO FIAT S.p.A.**
10156 Torino (IT)

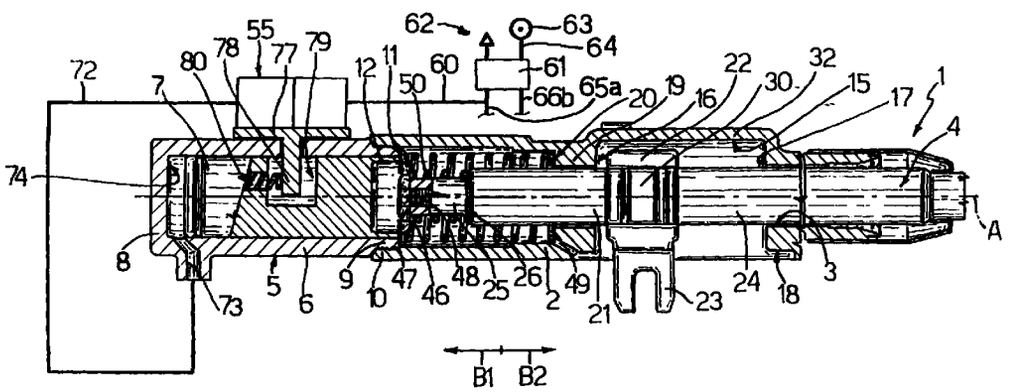
(72) Inventor: **Giuliani, Adriano**
25123 Brescia (IT)

(74) Representative:
Franzolin, Luigi et al
STUDIO TORTA S.r.l.,
Via Viotti, 9
10121 Torino (IT)

(54) Control device for a gear change of a vehicle

(57) A control device for a gear change of a vehicle, in particular a commercial vehicle, provided with a casing (2), a control member (4) accommodated inside the casing (2) so as to be able to travel along its axis (A) to carry out a selection operation in the range of gears and occupy at least two selection positions (S4,S5), and so as to be able to rotate about said axis (A) to carry out a gear engagement/disengagement operation, with a first spring (49) interposed between the casing (2) and the control member (4) and adapted to exert along the axis (A) a first force (B1) on the control member (4) itself so as to bring it into abutment with a first stop means (11) defining a first (S5) of said selection positions (S4,S5), with a second spring (50) adapted to exert on the control member (4) a second force (B2) opposing the first force (B1) to displace the control member (4) itself towards a second stop member (31) defining a second (S4) of said selection positions (S4,S5), with a pneumatic cylinder co-operating with the spring (49,50) to counteract selectively the first and second forces (B1,B2) and bring the control member (4) in a stable manner respectively in the second selection position (S4) and in the first selection position (S5), and with a timed control unit (5) for controlling the pneumatic cylinder (5).

Fig.1



EP 0 907 044 A1

(Cont. next page)

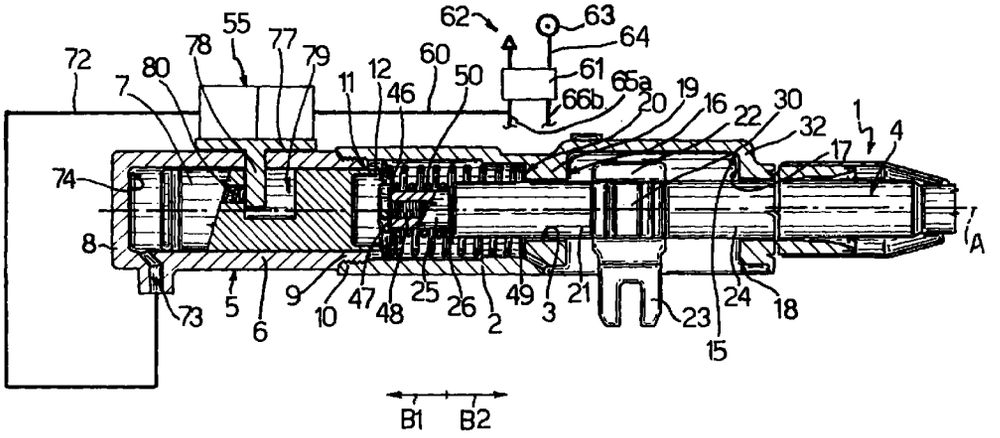

72
7
80
78
55
77
79
11
12
46
60
50
62
63
64
61
65a
66b
20
19
16
22
30
32
17
1
4
74
8
73
5
6
9
10
47
48
25
26
2
49
3
21
23
15
24
18
A
B1
B2

Fig. 2

Description

[0001] The present invention relates to a control device for a gear change of a vehicle, in particular a commercial vehicle.

[0002] As is known, gear changes of commercial vehicles generally comprise a main unit and a reduction unit coupled to the main unit itself and normally available in two different operational configurations, respectively direct drive (unitary reduction ratio) and reduction (reduction ratio differing from unity).

[0003] Control devices for gear changes of the above-mentioned type are known and essentially comprise a support member adapted to be rigidly connected to the gearbox and a control member carried by the support member so as to be able to travel along its axis so as to carry out a selection operation in the range of gears, and so as to be able to rotate about the axis itself to carry out a gear engagement/disengagement operation; generally, said gear changes are of the type with eight or nine gears and, therefore, the control member is adapted to occupy along its axis three selection positions corresponding to the reduction configuration of the reduction unit, namely "reduced selection positions", and two selection positions corresponding to the direct drive configuration, namely "direct selection positions".

[0004] Moreover, said control devices comprise elastic means for stabilizing, in said reduction and direct drive configurations, respectively one of the reduced selection positions and one of the direct selection positions.

[0005] In particular, in the event in which the first direct selection position is stabilised in the direction of the higher gears, because of the closeness with which the various selection positions are arranged with respect to one another errors may occur in the operation of the gear change when ascending, for example passing from a gear associated with the final direct selection position to a lower gear associated with the first position of direct selection. In fact, during this operation, the elastic means tend to return the control member into the stable first direct selection position and, therefore, it may happen that the successive movement of the control member, made by the driver of the vehicle to engage the next gear, will put the control member itself in the reduced selection position which is closest in the direction of the lower gears, with the consequent risk of inducing harmful overrevving of the engine.

[0006] To obviate this disadvantage, it could be considered to arrange the elastic means in such a way as to cause the final direct selection position to be stable in the direction of the higher gears; however, in this case, when one of the gears associated with the final reduced selection position is engaged in the direction of the higher gears, it may happen that during the operation of disengaging said gear and selecting and engaging a successive higher gear, i.e. associated with the first direct selection position, the elastic means return the control member in the stable final direct selection position and, therefore, the successive movement of the control member carried out by the driver of the vehicle will result in the engagement of an excessively high gear.

[0007] The object of the present invention is to devise a control device for a gear change of a vehicle, which makes it possible to obviate the drawbacks associated with the above-mentioned known control devices.

[0008] This object is achieved by the present invention in that it relates to a control device for a gear change of a vehicle, in particular a commercial vehicle, comprising:

- fixed support means;
- a control member carried by said support means so as to be able to travel along an axis to carry out a selection operation in the range of gears, and so as to be able to rotate about said axis to carry out a gear engagement/disengagement operation, said control member being adapted to occupy along said axis at least two selection positions in the range of gears, and
- first elastic means interposed between said support means and said control member and adapted to exert along said axis a first force on the control member itself so as to bring it into abutment with first stop means defining a first of said selection positions,

characterised by comprising second elastic means adapted to exert on said control member a second force opposed to said first force so as to move the control member itself towards second stop means defining a second one of said selection positions, actuator means co-operating with said first and second elastic means for selectively counteracting said first and second forces and arranging in a stable manner said control member respectively in said second selection position and in said first selection position, and timed control means for controlling said actuator means.

[0009] With a view to a better understanding of the present invention a preferred embodiment will be described non-restrictively by way of example below and with reference to the accompanying drawings, in which:

Figure 1 is an axial section of control device for a gear change of vehicle, in particular a commercial vehicle, designed in accordance with the present invention and arranged in a first operational configuration;

Figure 2 is an axial section of the device in Figure 1, in a second operational configuration;

Figure 3 illustrates a simplified diagram of the engagement and selection positions occupied by a control member of the device in Figures 1 and 2;

Figure 4 is a cross-section of the device in Figure 1;

Figure 5 is a hydraulic diagram of a control unit of the device in Figures 1 and 2, and

Figures 6 to 10 illustrate on an enlarged scale a detail of the device in Figure 1, in different operating positions.

[0010] Referring now to Figures 1 and 2, the reference numeral 1 generally denotes a control device for a gear change (known and not shown) of a vehicle (also not shown), in the case of a gear change of a commercial vehicle of the type with nine gears and comprising a main unit and a pneumatically actuated reduction unit (known and not shown) coupled to the main unit itself and available in two different operating configurations, one of which, or direct drive configuration, is defined by a unitary reduction ratio, whereas the other configuration, namely the reduction configuration, is defined by a predetermined reduction ratio differing from unity.

[0011] The device 1 comprises a substantially tubular elongate casing 2 adapted to be rigidly connected to the gearbox (not shown) and defining internally a continuous longitudinal cavity 3 having an axis A, a control member 4 engaging coaxially in the cavity 3 and supported by the casing 2 so as to be axially displaceable and angularly rotatable about the axis A itself, and actuated by a lever (known and not shown) for manual selection of the gear ratios.

[0012] In particular, the control member 4 can move along the axis A so as to effect a selection operation in the range of gears and it can rotate about the axis A itself to carry out an engagement/disengagement operation of the selected gear; the movements of the control member 4 are transmitted to the gear change via transmissions of a known type (not shown).

[0013] In the case illustrated, the control member 4 is adapted to occupy five axial selection positions of respective gear ranges, denoted in Figure 3 by S1,S2,S3,S4, S5 and, for each gear range, is adapted to occupy two angular engagement positions, with which are associated respective consecutive gears of the gear change. More precisely and with reference to Figure 3, the selection position S1 is associated with the reverse gear R and the gear I, the selection position S2 is associated with the gears II and III, the selection position S3 is associated with the gears IV and V, the selection position S4 is associated with the gears VI and VII, and the selection position S5 is associated with the gears VIII and IX.

[0014] The gears R, I,II,III, IV and V associated with the selection positions S1,S2,S3 are obtained by arranging said reduction unit in the reduction configuration and are designated "reduced gears", whereas the gears VI, VII,VIII and IX associated with the selection positions S4,S5 are obtained by arranging the reduction unit in the direct drive configuration and are designated "direct drive gears" (or direct gears).

[0015] The device 1 further comprises a pneumatic cylinder 5 with an axis A, which comprises a casing 6 securely connected to the casing 2 and a piston 7 mounted to slide fluidtightly in the casing 6 and co-operating with the control member 4. In particular, the casing 6 has a blind end portion 8 and an open opposite end portion 9 which has an external screw thread and is screwed into an internally threaded end portion 10 of the casing 2; the portion 9 of the casing 6 defines with an end edge thereof an axial shoulder 11 turned towards the inside of the cavity 3 of the casing 2.

[0016] The piston 7 comprises a cylindrical body with an axis A having a substantially cup-shaped end portion 12 and co-operating with the control member 4 in a manner which will be described in detail below; the piston 7 is normally disposed in an inoperative position, in which an end edge of its portion 12 is disposed axially aligned with the shoulder 11.

[0017] With reference to Figures 1,2 and 4, the cavity 3 has an intermediate portion 15 of greater section with respect to the rest of the cavity 3 itself, bounded axially by a pair of walls 16,17 and communicating with the outside through a lateral opening 18 of the casing 2, which is extended in the direction of the axis A.

[0018] Of the walls 16 and 17 the wall 16 is part of an annular projection 19 with an axis A protruding radially inside the cavity 3; the projection 19 also has an opposite lateral face turned towards the cylinder 5 and defining a further axial shoulder 20 facing the shoulder 11, the purpose of which will be explained below.

[0019] The control member 4 comprises a cylindrical rod 21 with an axis A engaging in the cavity 3 in an axially displaceable and angularly rotatable manner, and an actuating member 22 which is keyed on the rod 21 and which is movable inside the portion 15 of the cavity 3 between the walls 16 and 17 and having a substantially fork-shaped end portion 23 which engages with play in the opening 18, which protrudes outside the casing 2 and is adapted to co-operate with levers of known type (not shown), controlled by said gear-selection lever.

[0020] The rod 21 comprises a main portion 24, on which is keyed the actuating member 22, and an end portion 25 adjoining the piston 7 and of smaller diameter than the diameter of the portion 24 and defining with the portion 24 itself an axial shoulder 26 facing the piston 7.

[0021] With particular reference to Figure 4, the actuating member 22 has a side wall 30 curved in the form of a cam and with an axis A, which co-operates slidingly during the selection operation of the gears with an elastic cap 31 carried by a side wall 32 of the casing 2 bounding the portion 15 of the cavity 3.

[0022] In particular, the cap 31 comprises a hollow cylindrical body 33 tapering towards one end 34 thereof which is substantially of rounded tip shape, it is mounted to slide in a hole 35 in the wall 32 having a radial axis with respect to the axis A, it projects in an intermediate position inside the portion 15 of the cavity 3 and is loaded by a cylindrical helical spring 36 accom-

modated coaxially inside the body 33 and having one end connected to a protuberance 37 of the wall 32 and an opposite end connected to the body 33 itself.

[0023] With particular reference to Figures 6 to 10, the wall 30 has, starting from one axial end of the actuating member 22 facing the wall 26 and extending towards an opposite axial end, a curved surface 40 of constant radius disposed in contact with the cap 31 in the selection position S1 of the control member 4, a curved surface 41 with decreasing radius co-operating with the cap 31 in the selection position S2 of the control member 4, a curved surface 42 of constant radius and a pointed projection 43 defined by two curved surfaces 44,45 respectively of increasing and decreasing radius. The surfaces 44,45 are arranged in contact with the cap 31 respectively in the selection positions S3 and S4; finally, in the selection position S5 the actuating member 22 is spaced apart from the cap 31 and the control member 4 is disposed abutting against the shoulder 11 (Figure 1), as will be explained in detail below.

[0024] Therefore, during the gear-selection operation and thus during the displacement of the actuating member 22 along the axis A in both directions, the cap 31 constitutes a releasable stop member for the projection 43 and defines a single switching point for the reduction unit between the reduction and direct drive configurations.

[0025] With reference to Figures 1 and 2, the control member 4 further comprises a movable element 46 of substantially annular shape with an axis A and mounted to slide on the portion 25 of the rod 21 between the shoulder 26 and a head 47 of a screw 48 mounted in a blind threaded hole with an axis A provided in the portion 25 itself; more precisely, the head 47 of the screw 48 is of larger diameter than the diameter of the portion 25 and, therefore, prevents the removal of the movable element 46 towards the cylinder 5.

[0026] The device 1 further comprises a first cylindrical helical spring 49 accommodated coaxially inside the cavity 3 and interposed between the shoulder 20 of the casing 2 and the movable element 46, and a second cylindrical helical spring 50 with an axis A wound around the portion 25 of the rod 21 and interposed between the shoulder 26 and the movable element 46.

[0027] The spring 49 is adapted to exert a force B1 on the movable element 46 of the control member 4 along the axis A directed towards the cylinder 5 and tending to bring the movable element 46 into abutment against the shoulder 11 and, therefore, the control member 4 in the selection position S5 (Figure 1);1 instead, the spring 50 is adapted to exert a force B2 on the movable element 46 opposing the force B1 exerted by the spring 49 and tending to bring the surface 45 of the projection 43 of the control member 4 into abutment with the cap 31 (Figure 9).

[0028] In the reduction configuration of the reduction unit, the projection 43 of the actuating member 22 is positioned between the cap 31 and the wall 17 (Figures 6 to 8) and, therefore, the force B1 of the spring 49 tends to bring the movable element 46 and, therefore, the control member 4 towards the shoulder 11, maintains in a stable manner, in the absence of external actions on the gear-selection lever, the surface 44 of the projection 43 in abutment with the cap 31 and, therefore, maintains in a stable manner the control member 4 in the selection position S3.

[0029] In the direct-drive configuration of the reduction unit and with the piston 7 disposed in its inoperative position, the force B2 of the spring 50 is counteracted in that the projection 43 of the actuating member 22 is spaced apart from the cap 31 (Figure 10) and the control member 4 is subjected only to the force B1 of the spring 49 which brings the movable element 46 into abutment with the shoulder 11 and against the portion 12 of the piston 7.

[0030] According to an important feature of the present invention, the piston 7 can move from the inoperative position into an operative position (Figure 2), in which its portion 12 projects axially inside the cavity 3 with respect to the shoulder 11 so as to bring the surface 45 of the projection 43 into abutment with the cap 31 under the force B2 of the spring 50, thereby counteracting the force B1 of the spring 49, and to position in a stable manner the control member 4 in the selection position S4.

[0031] The device 1 further comprises a timed pneumatic control unit 55 adapted to control the displacement of the piston 7 from the inoperative position into the operative position at the moment at which the reduction unit is switched from the reduction configuration to the direct-drive configuration, and to maintain the piston 7 itself into the operative position for predetermined period of time T, in this case equal to several seconds.

[0032] With reference to Figures 1,2 and 5, the unit 55 and with it the cylinder 5 are supplied through a duct 60 and with the interposition of a distributor valve 61 by a pneumatic system 62 for actuating the reduction unit.

[0033] In particular, the valve 61, known per se and only illustrated schematically in Figures 1 and 2, has an inlet connected via a duct 65 to a compressed-air supply 63 for the system 62, a first consumer branch 65a connected to a control actuator (not shown) to bring the reduction unit into the direct-drive configuration and to the cylinder 7 via the duct 60, a second consumer branch 65b connected to a control actuator (not shown) to bring the reduction unit into the reduction configuration, and an outlet connected to the discharge. The valve 61 is movable between a first operative position, in which it connects the supply 63 with the consumer branch 65b and the consumer branch 65a with the discharge, and a second operative position, in which it connects the supply 63 with the consumer branch 65a (and therefore in shunt with the duct 60) and the consumer branch 65b with the discharge.

[0034] The unit 55 comprises a control valve 66 for the cylinder 5 interposed between the cylinder 5 itself and

the compressed-air supply 63, which is normally open to move the piston 7 from the inoperative position into the operative position as soon as compressed air is fed into the duct 60, and a timed pneumatic control valve 67 controlling the valve 66, for displacing and maintaining the valve 66 itself in the closed position after the period of time T.

[0035] In particular, the valve 66 is of three-way type with two positions and has an inlet 68 connected to the supply 63 via the ducts 60 and 65, a first outlet 71 connected via a consumer duct 72 with an orifice 73 provided in the casing 6 of the cylinder 5, and a second outlet 70 connected to the discharge; in particular the orifice 73 communicates the duct 72 with a chamber 74 provided in the casing 6 of the cylinder 5 and defined by the blind end portion 8 of the casing 6 itself and by the piston 7.

[0036] The valve 66 is normally held open by a spring 75 set at an equivalent predetermined pressure value and is induced to close by its inlet pressure via a control duct 76 connected with the duct 60 via the valve 67.

[0037] The valve 67, of known type, is disposed in series with the duct 76, is normally arranged in a position closing the connection between the duct 76 itself and the valve 66 and it is induced to open after the period of time T by the delivery pressure of the supply 63.

[0038] Finally, as is evident from Figures 1 and 2, the valves 66,67 are supported by a cover 77 mounted externally on the side wall of the casing 6, which is of substantially T-shaped cross-section and which has a portion 78 projecting inside the casing 6 itself and engages with ply in a slot 79 in the piston 7; the portion 78 of the cover 77 is connected to the piston 7 by a spring 80 adapted to facilitate rapid displacement of the piston 7 from the operative position into the inoperative position when the air is discharged from the chamber 74 of the cylinder 5.

[0039] The mode of operation of the device 1 will be described starting from an initial condition in which the gear V is engaged and the valve 61 is disposed in the first operative position and, therefore, maintains the reduction unit in the reduction configuration. To pass from the gear V to a successive higher gear, for example to gear VI or VII, it is necessary to turn the control member 4 about the axis A until reaching the selection position S3, which is a stable position and is defined by the surface 44 of the projection 43 coming into abutment with the cap 31 under the force B1 of the spring 49 (Figure 8).

[0040] By moving the control member 4 axially towards the cylinder 5, the projection 43 passes over the cap 31 and the selection position S4 is reached. At the same time as this movement, the valve 61 is switched into the second operative position and the reduction unit is disposed in the direct-drive configuration.

[0041] The air delivered from the supply 63 is thus fed to the duct 60 and the valve 66, which is in the open position, allows air to flow into the chamber 74 of the cylinder 5 causing displacement of the piston 7 from the inoperative position into the operative position, in which it forms an abutment for the movable element 46 and renders the selection position S4 stable. At this point it is only necessary to turn the control member 4 about the axis A to engage the gear VI and, successively, the gear VII associated with the selection position S4.

[0042] When the period of time T has passed, which is chosen so as to make it possible to pass easily from the gear V to the gears VI and VII, the valve 67 opens the connection between the duct 76 and the valve 66 and, therefore, the valve 66 itself is brought into the closed position, thus opening the orifice 70 so as to connect the chamber 74 with the discharge. The piston 7 returns into the inoperative position and the selection position S5 is thus stabilized so as to facilitate the successive passage into one or both of the gears VIII, IX associated therewith.

[0043] Finally, to pass from one of the gears VIII or IX associated with the selection position S5 to one of the gears VI or VII associated with the selection position S4, the actuating member 22 is displaced towards the wall 17; the travel of the actuating member 22 induces the portion 25 of the rod 21 to move away from the piston 7 and, because of the head 47 of the screw 48 and the spring 50, it entrains the movable element 46 with it, which compresses the spring 49; since in this phase the stable selection position is still the position S5 there is not the danger of engaging a gear associated with the selection position S3 and thereby inducing harmful overrevving of the engine, as could occur in known gear-change control devices.

[0044] The advantages which can be achieved with the present invention are evident from a study of the features of the device 1.

[0045] The switching into the second operating position of the distributor valve 61 (which brings the reduction unit into the direct-drive configuration) initiates each time an operating cycle of the valves 66 and 67 which terminates with a stabilised selection position (S5) for all the time that the reduction unit remains in the direct-drive configuration.

[0046] In particular, the co-operation of the cylinder 5 with the springs 49,50 makes it possible to bring out a first stable selection position (S4) of the control member 4 in the phase of upward gear changes from the reduction configuration into the direct-drive configuration of the reduction unit, so as to obviate the engagement of gears which are too high and, after a period of time T, makes it possible to stabilise a second selection position (S5) of the control member 4 so as to avoid, in the phase of downward gear changes from the selection position S5 towards the selection position S4, jumping this latter selection position and engaging gears which are too low, thereby inducing harmful overrevving of the vehicle's engine.

[0047] Furthermore, the cylinder 5 does not require a dedicated pneumatic system because as it has to operate in phase with respect to the reduction unit it can be connected to the distributor valve 61, in the consumer branch 65a of the latter connected to the control actuator so as to bring the reduction unit into the direct-drive configuration.

[0048] It is evident that the device 1 can be subject to various modifications and variations without departing from the scope of protection defined by the claims.

Claims

1. A control device (1) for a gear change of a vehicle, in particular a commercial vehicle, comprising:

   - fixed support means (2);
   - a control member (4) carried by said support means (2) so as to be able to travel along an axis (A) to carry out a selection operation in the range of gears, and so as to be able to rotate about said axis (A) to carry out a gear engagement/disengagement operation, said control member (4) being adapted to occupy along said axis (A) at least two selection positions (S4,S5) in the range of gears, and
   - first elastic means (49) interposed between said support means (2) and said control member (4) and adapted to exert along said axis (A) a first force (B1) on the control member (4) itself so as to bring it into abutment with first stop means (11) defining a first (S5) of said selection positions (S4,S5),

   characterised by comprising second elastic means (50) adapted to exert on said control member (4) a second force (B2) opposed to said first force (B1) so as to move the control member (4) itself towards second stop means (31) defining a second one (S4) of said selection positions (S4,S5), actuator means (5) co-operating with said first and second elastic means (49,50) for selectively counteracting said first and second forces (B1,B2) and arranging in a stable manner said control member (4) respectively in said second selection position (S4) and in said first selection position (S5), and timed control means (55) for controlling said actuator means (5).

2. A device according to claim 1, characterised in that said actuator means (5) comprise an output member (7) interacting with said control member (4) and able to move between two positions, respectively inoperative and operative, corresponding respectively to said first and second selection positions (S5,S4) of said control member (4) so as to counteract respectively said second force (B2) of said second elastic means (50) and said first force (B1) of said first elastic means (49), said timed control means (55) comprising control means (66) which can be actuated selectively at a predetermined moment of said selection operation so as to bring said output member (7) of said actuator means (5) into said operative position and timer means (67) co-operating with said control means (66) to move said output member (7) into said inoperative position after a predetermined period of time (T).

3. A device according to claim 2, for a gear change of a vehicle, comprising a main unit and a reduction unit coupled to the main unit itself and normally available in two different operational configurations, respectively direct drive and reduction, characterised in that said control member (4) is adapted to occupy, in said direct-drive configuration of said reduction unit, said first and second selection positions (S5,S4) and, in said reduction configuration of the reduction unit itself, a plurality of third selection positions (S3,S2,S1) disposed successively on the opposite side of said second selection position (S4) with respect to said first selection position (S5), said control means (66) being actuated when said reduction unit is switched from said reduction configuration into said direct drive configuration.

4. A device according to claim 2 or 3, characterised in that said support means comprise a casing (2) defining a cavity (3) coaxial with said axis (A), and in that said control member (4) comprises a rod (21) engaging coaxially in said cavity (3) and supported by said casing (2) in an axially displaceable and angularly rotatable manner, and a movable element (46) mounted to slide on said rod (21) between two abutment elements (26,47) provided on said rod (21) itself and loaded on one side by said output member (7) of said actuator means (5) and on the opposite side by said first and second elastic means (49,50), said first elastic means (49) being interposed between said movable element (46) and a first shoulder (20) of said casing (2) and said second elastic means (50) being interposed between the movable element (46) itself and a first one (26) of said abutment means (26,47) disposed on the opposite side of said actuator means (5).

5. A device according to claim 4, characterised in that said actuator means comprise a fluid-operated cylinder (5) provided with an outer casing (6) which is blind at one end (8) and open in alignment with the opposite end (9) and which is securely connected at one end (10) of said casing (2) and in which said output member (7) engages sliding fluidtightly therein, said casing (6) being mounted partly inside said casing (2) and defining with an annular end edge thereof facing said first shoulder (20) of the casing (2) itself a second shoulder (11) forming said

first stop means.

6. A device according to claim 4 or 5, characterised in that said second stop means are releasable stop means and comprise an elastic cap (31) carried by said casing (2) and arranged spaced apart from said first stop means (11) along said axis (A) and extending radially with respect to said axis (A) itself, said control member (4) comprising a pointed projection (43) adapted to abut against said cap (31) in said second selection position (S4) and in an associated one (S3) of said third selection positions (S1,S2,S3), said cap (31) defining, during said selection operation in the range of gears, a single switching point of said reduction unit between said reduction and direct-drive configurations.

7. A device according to claim 6, characterised in that said output member (7) of said actuator means (5) defines, in its inoperative position and together with said first stop means (11), an abutment for said movable element (46) loaded by said first elastic means (49) so as to maintain said pointed projection (43) spaced apart from said cap (31) and to counteract said second force (B2) of said second elastic means (50), said output member (7) being arranged, in said operative position, partly projecting inside said cavity (3) so as to bring said pointed projection (43) into abutment with said cap (31) under the force (B2) of said second elastic means (50) and to counteract said first force (B1).

8. A device according to any one of claims 4 to 7, characterised in that said output member (7) of said actuator means (5) has a cup-shaped end portion (12) co-operating with said movable element (46).

9. A device according to any one of the preceding claims, characterised in that said first and second elastic means comprise respective cylindrical helical springs (49,50) coaxial with said axis (A).

10. A device according to any one of claims 5 to 9, characterised in that said cylinder (5) is a pneumatically actuated cylinder and in that said control means comprise first valve means (66) which are interposed between a compressed-air supply (63) and said cylinder (5) and which can move between a closed position, in which they connect said cylinder (5) to the discharge, and an open position, in which they connect said supply (63) to said cylinder (5), and which are normally disposed in said open position, said timer means comprising second timed valve means (67) controlling said first valve means (66).

11. A device according to claim 10, characterised in that said reduction unit is a pneumatically actuated reduction unit and comprises third valve means (61) which can move between a first position, in which they connect said compressed-air supply (63) to said reduction unit in the reduction configuration and induce said cylinder (5) to discharge, and a second position, in which they connect said compressed-air supply (63) to said reduction unit in the direct-drive configuration and to said cylinder (5).

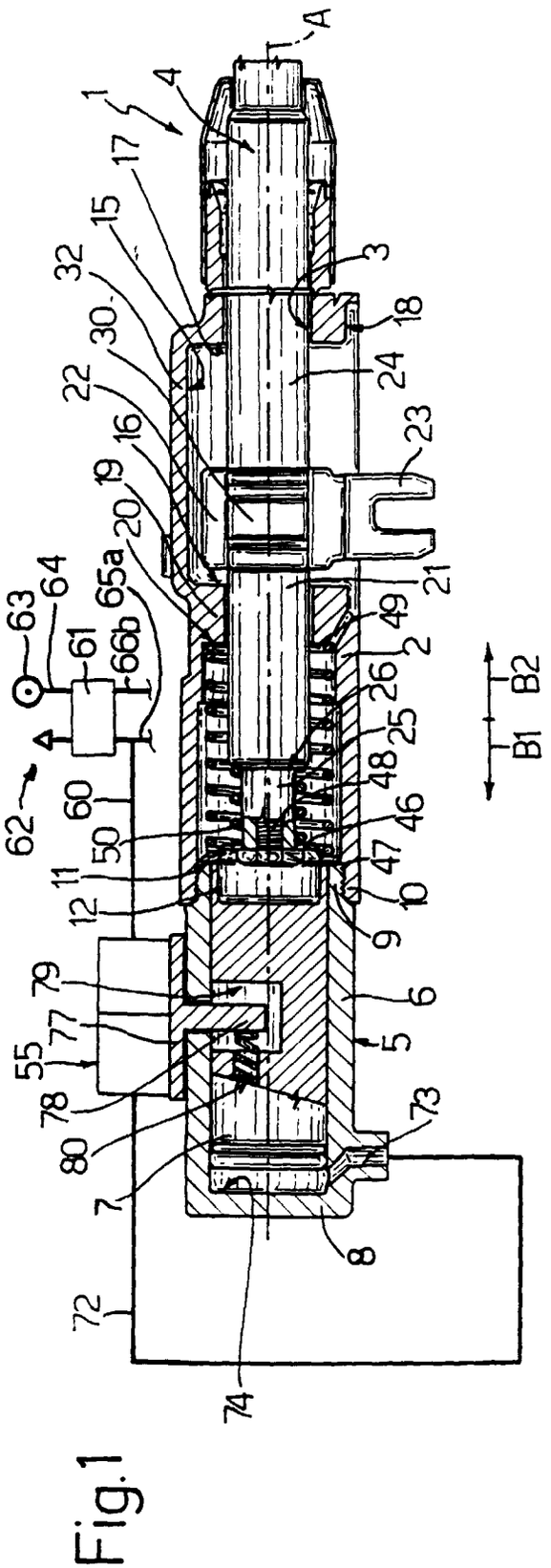


Fig.1

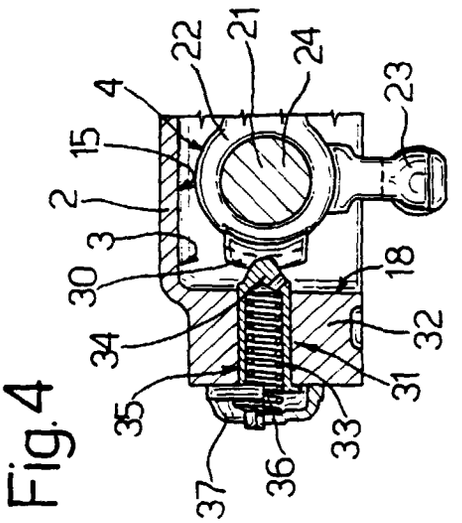


Fig.4

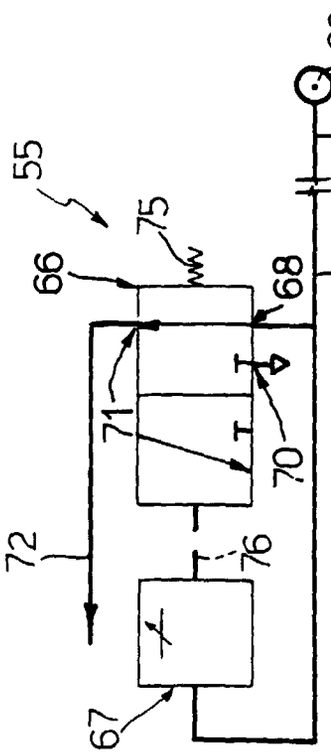


Fig.5

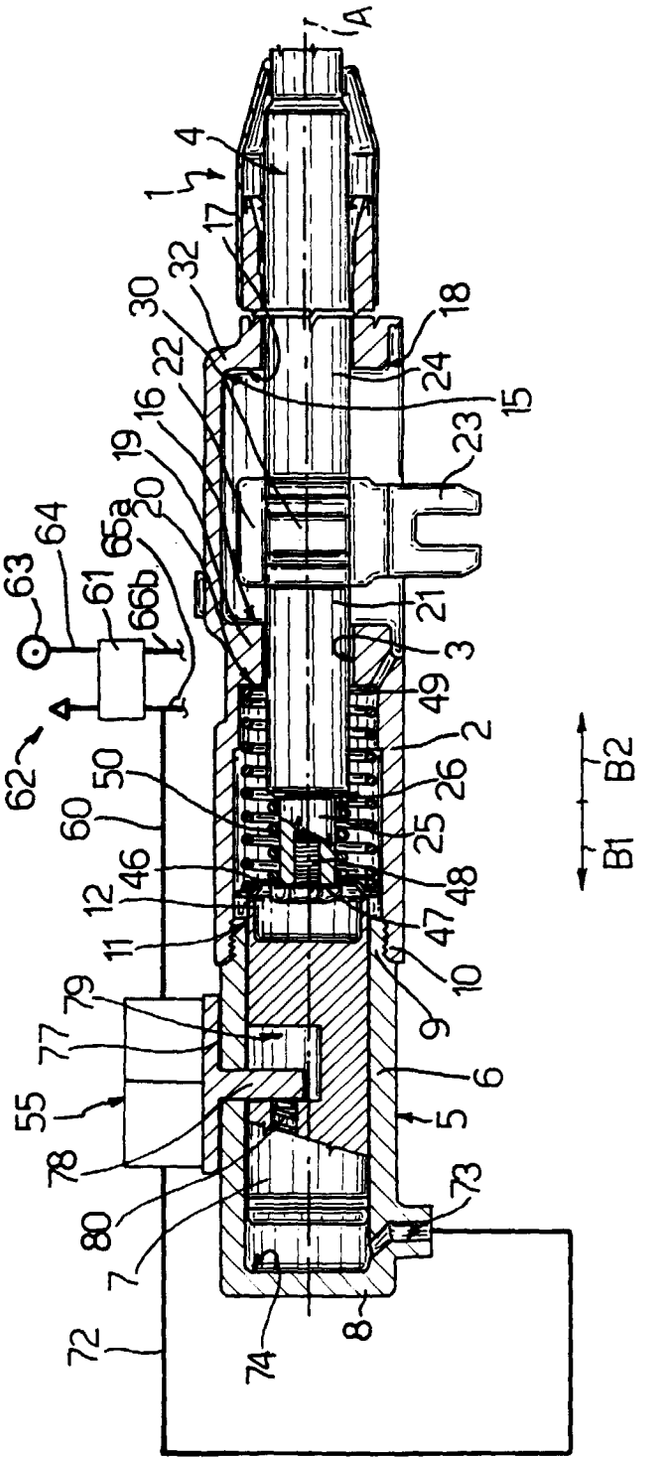


Fig.2

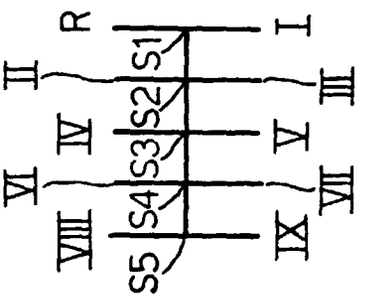


Fig.3

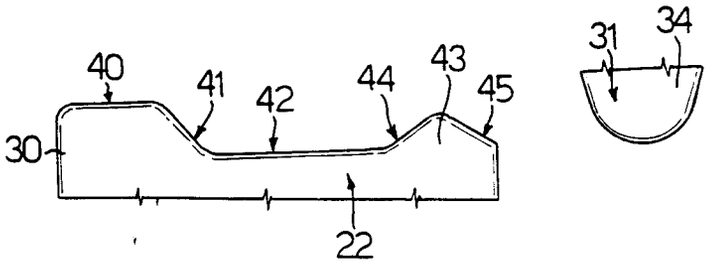


Fig. 10

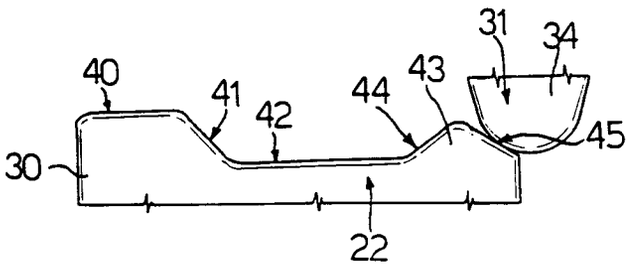


Fig. 9

Fig. 8

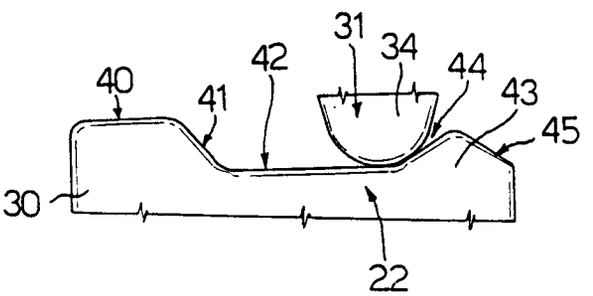


Fig. 7

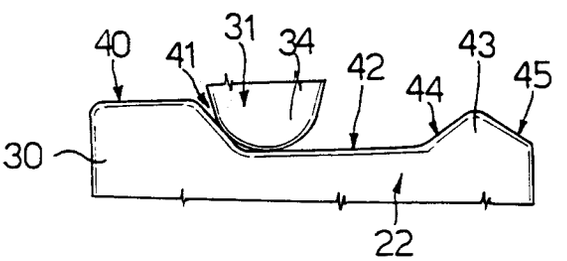
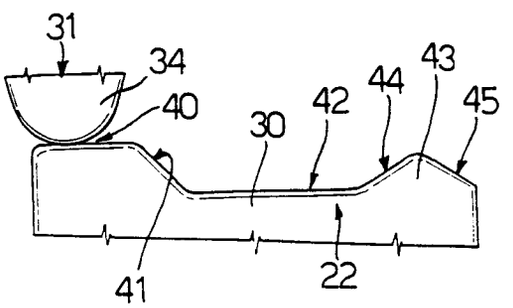


Fig. 6



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 11 8598

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	EP 0 365 033 A (IVECO FIAT S.P.A.) 25 April 1990 * the whole document *	1,2	F16H61/30
Y	FR 2 007 681 A (WESTINGHOUSE BREMSEN- UND APPARATEBAU G.M.B.H.) 9 January 1970 * figures 1-4 *	1,2	
A	DE 32 13 757 A (AUTOIPARI KUTATO INTEZET & CSEPEL AUTOGYAR) 20 January 1983 * the whole document *	1	
A	US 5 189 942 A (OHKUBO, MASAHIRO) 2 March 1993 * the whole document *	1	
A	US 2 137 959 A (TUREK, THOMAS J.) 22 November 1938 * figures 4,5 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			F16H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 December 1998	Van Prooijen, T

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 98 11 8598

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-12-1998

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0365033 A	25-04-1990	DE 68914771 D	26-05-1994
		DE 68914771 T	13-10-1994
		ES 2051957 T	01-07-1994
FR 2007681 A	09-01-1970	NONE	
DE 3213757 A	20-01-1983	SE 457820 B	30-01-1989
		SE 8202347 A	17-10-1982
US 5189942 A	02-03-1993	JP 3194201 A	23-08-1991
		DE 4092384 C	16-11-1995
		DE 4092384 T	30-01-1992
		WO 9110069 A	11-07-1991
US 2137959 A	22-11-1938	FR 815800 A	22-07-1937

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82